

Radio-Frequency Identification (RFID) Technology for Transportation Signage Inventory Management

Tian Xia , Byung Lee, Wenzhe Chen, Joshua Childs, Saraf Ray

Department of Electrical and Biomedical Engineering

Department of Computer Science

University of Vermont

Introduction

Traffic signage inventory management is an important part of transportation asset management. This project develops a novel transportation asset inventory management system employing RFID technology for traffic signage management (Fig. 1a). In this system, RFID tags are attached to traffic signs deployed along the roadway, and an RFID reader (Fig. 1b) mounted on a survey vehicle performs RFID tag interrogation and data processing while moving at a normal driving speed. In addition, a handheld RFID reader (Fig. 1c) is used to scan tags in close range, which renders the overall system more versatile to different operation scenarios. A remote database in the backend manages tag attribute data. The database server can communicate with both in-vehicle and handheld readers in real time.

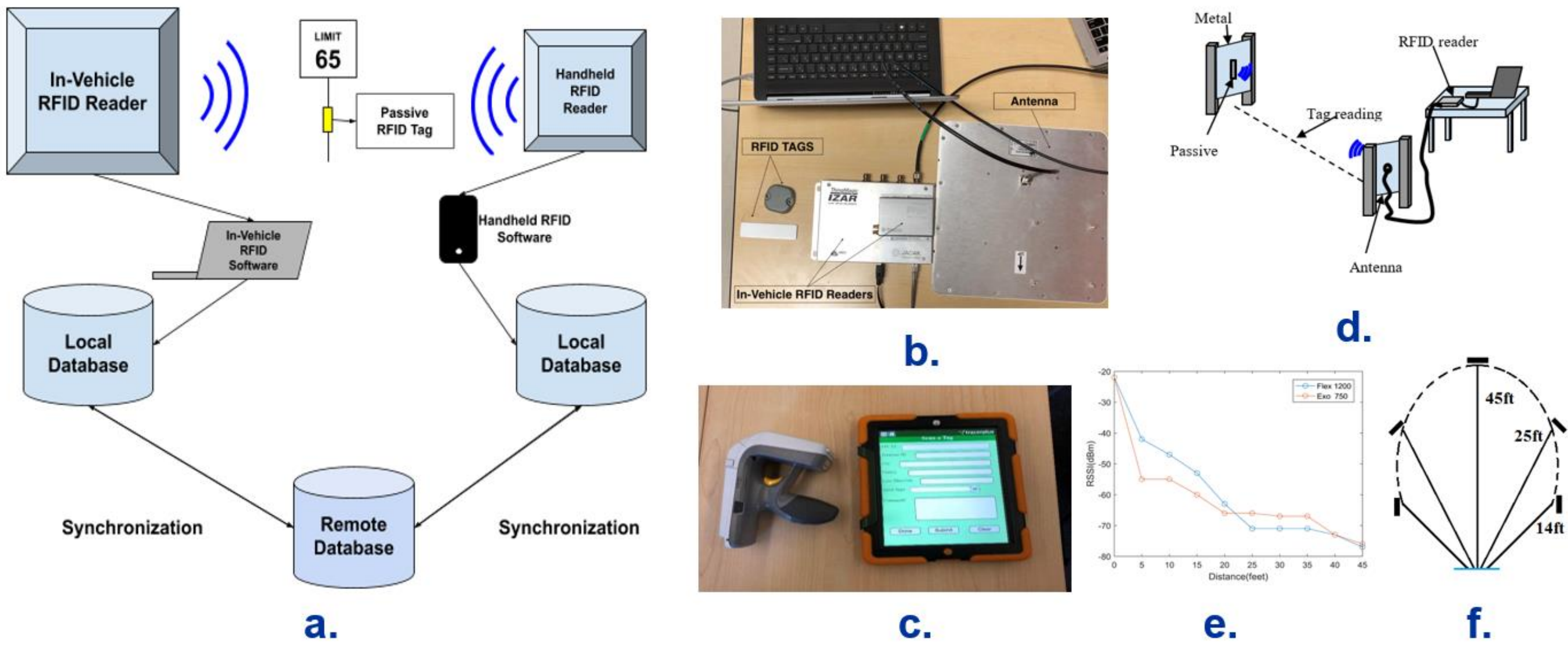


Figure 1. a) System overview; b) in-vehicle RFID reader; c) handheld RFID reader; d) lab test configuration; e) maximum reading distance; f) reading range.

Laboratory test

The developed system is evaluated comprehensively through lab test(Fig. 1d). Received Signal Strength Indicator (RSSI) is used as the primary metric to evaluate the maximum reading distance and performance (Fig. 1e). The reading range is the area covered by the reader in detecting a tag (Fig. 1f).

Software

A customized program (Fig. 2a) is developed to implement with a number of functionalities: i) filtering tag IDs based on a designed criterion; ii) reading and displaying tag data and tag ID (EPC); iii) saving the tag data to a CSV file; iv) writing custom EPC IDs to tags. The handheld reader is used for individual tag reads to display or modify the relevant tag information (Fig. 2b).

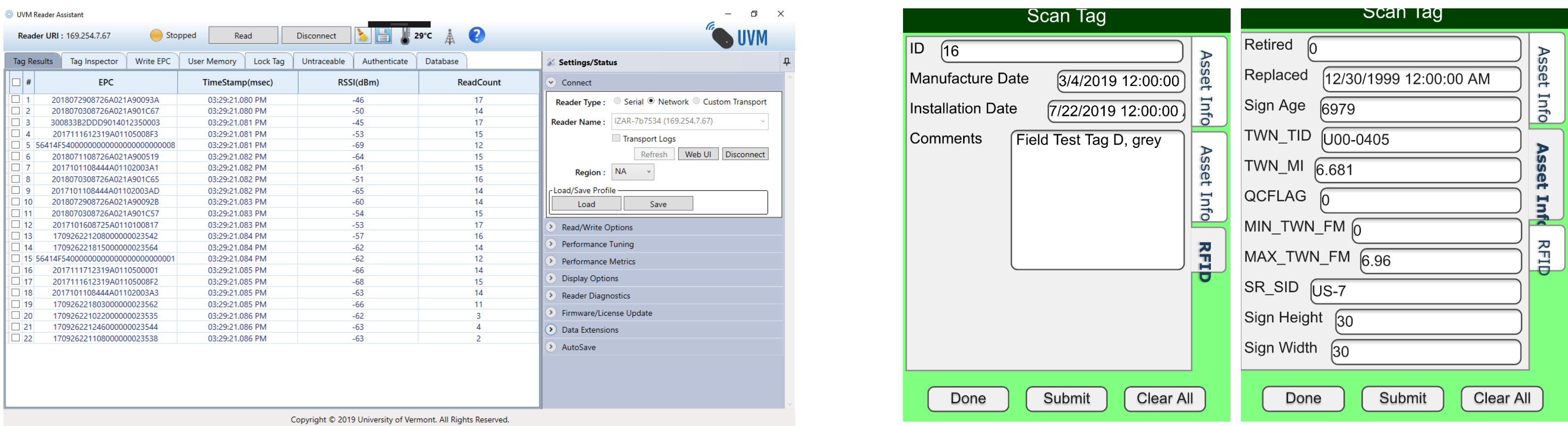


Figure 2. Software for a) in-vehicle reader; b) handheld reader.

Filed test

A comprehensive test is performed involving both in-vehicle reader and handheld reader on a real traffic route (VT State Route 63) (Fig. 3). All tags on traffic sign poles and guard rails are detected at the speed of up to 35mph.

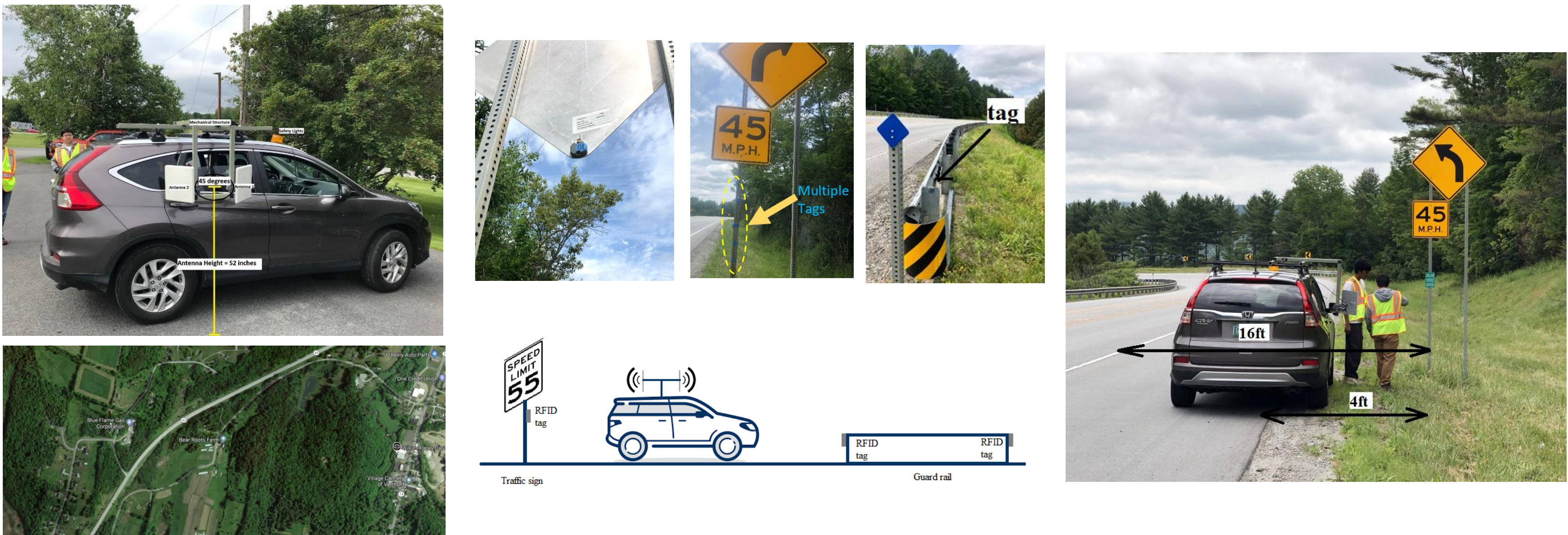


Figure 3. Photos of field test.

Distance (ft)	Vehicle Speed (mph)	Average signal strength (RSSI)	Reading Percentage		
			Antenna1 (circular)	Antenna2 (linear)	Total
4	25	-64	100%	100%	100%
4	35	-65	100%	100%	100%
4	55	-77	100%	~	100%
16	20	-63	91.67%	100%	100%
16	35	-70	83.34%	100%	100%
34	20	-65	75%	100%	100%
34	35	-74	50%	100%	100%

Acknowledgments

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